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THE JOURNAL

OF

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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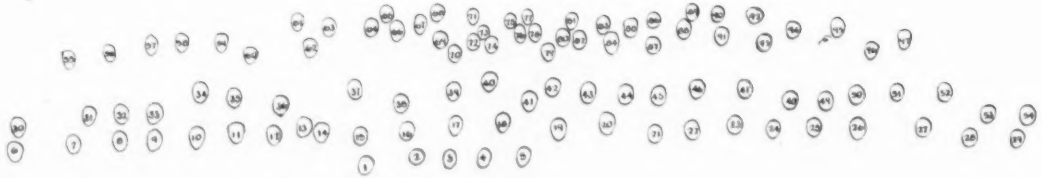
THE FIFTY-FOURTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY,
Toronto, September 10-12, 1935



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3. Elizabeth McLaughlin
4. Alberta McLaughlin
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6. Pawling
7. M. M. Thomson
8. Kiess
9. R. M. Motherwell
10. D. B. Nugent
11. W. S. McClenahan
12. F. L. Troyer
13. W. C. Jaques
14. Mrs. Jaques
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18. Mrs. McLaughlin
19. Russell
20. F. C. Jordan
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55. Hogg
56. Stilwell
57. Millman
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59. Brigham
60. Mrs. Brigham
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64. Tabor
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THE JOURNAL
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Vol. XXIX, No. 8 OCTOBER, 1935 Whole No. 247

THE FIFTY-FOURTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

By J. F. HEARD

(With Plate XVIII)

THAT the American Astronomical Society is American in the fullest sense of the word was demonstrated when that Society accepted the invitation of the University of Toronto to hold its fifty-fourth meeting here on September 10, 11 and 12. The arrangement was very opportune, this year being, as Dr. Cody remarked, the University's Astronomical Year. And, if we may be permitted to flatter ourselves, it seemed that the members of the Society were glad of an opportunity to see our University and, perhaps particularly, our new astronomical equipment, for the attendance was unusually good. Members were present from all the major observatories of North America, including such distant ones as Yerkes, Lick, Mount Wilson and Victoria. We were also very pleased that a good many members of the R.A.S.C. accepted Dr. Chant's invitation to attend the sessions.

From a scientific standpoint there is no doubt that the meeting was a success. In the four sessions some thirty papers were read by members of the Society and there was no lack of spirited discussion. To discuss all the papers here would be quite impossible; suffice to say that they ranged in topic from double star programmes to the "latest" on Nova Herculis and that at no time were there any signs of restlessness or boredom.

The members attending the meeting arrived Tuesday morning, September 10, and registered at University College, most of them having already reserved accommodation at the University residences by previous arrangement. The first session for papers began promptly at 2 p.m. at the David Dunlap Observatory. President Russell opened the meeting and after a brief but hearty welcome by Dr. Chant the sober business of hearing papers was begun. At about four o'clock it was unanimously decided that we had had enough of sobriety for the time being and the meeting was adjourned. For the rest of the afternoon the astronomers made themselves at home in and about the observatory buildings and inspected and praised and criticized our equipment as only astronomers can. In the midst of it all, a very informal supper was served by the ladies of the observatory staff; and when darkness came the visiting astronomers had a busman's holiday doing some star-gazing with the "74-inch."

On Wednesday there were two sessions for papers at the observatory, one in the forenoon and one in the afternoon. At noon the question of lunch was solved by the ladies of the United Church in Richmond Hill who provided a very excellent meal in the school auditorium. After the afternoon session the members in assorted automobiles followed Dr. Chant along the tortuous route to Donalda Farm where they were received by Mrs. Dunlap as hostess and by His Honour, the Lieutenant-Governor and Mrs. Bruce as guests of honour and were entertained at a garden party in Mrs. Dunlap's beautiful gardens.

Thursday was the last day of the meeting, but not the least. At the morning session which was held in the Physics Building all the remaining papers were read and discussed. Dr. Chant spoke briefly of the history of the observatory and a vote of appreciation to the University was passed by the members of the Society.

The remainder of Thursday was reserved for social occasions. In the afternoon the members were entertained at tea in the clubhouse of the Royal Canadian Yacht Club. In the evening the meetings came to a very fitting close with a dinner at Hart House. Dr. Cody, who had been unable to attend the opening session, extended to the visitors a "belated but none the less sincere" welcome. He spoke of his own interest in astronomy and of the

great popular interest in the subject which had been engendered by Mrs. Dunlap's handsome gift to the University, and of his admiration for the work of Dr. Chant, our emeritus director, and of Dr. Young, the present director. He expressed the pleasure of the University at having the honour to be hosts to the American Astronomical Society, and he hoped that the goodwill which was so apparent between astronomers of the United States and Canada was typical of the goodwill which would always be felt between the two countries. Dr. Russell, president of the Society, in reply to Dr. Cody, thanked the University for their hospitality and enthusiastically endorsed the expression of goodwill; and, with reference to Dr. Cody's somewhat awed remarks concerning astronomers and their work, he let Dr. Cody "in on" that iconoclastic secret that the reason why astronomers do astronomy is that it is "such good fun."

The following resolution of thanks was presented by Dr. C. H. Smiley and Dr. Alice Farnsworth and was passed unanimously by the Society:

At the close of this third meeting in Canada, we, the members of the American Astronomical Society, desire to record our grateful appreciation of the hospitality of the University of Toronto and in particular of the careful planning and untiring efforts of Professor Chant, Professor Young and the staff of David Dunlap Observatory in making this meeting an outstanding success.

We desire also to thank the ladies of the United Church of Richmond Hill for their kindness in providing the excellent lunch.

To the Royal Canadian Yacht Club, we express our sincere appreciation of the excellent entertainment they have arranged for us.

In particular, we should like to emphasize our gratitude to Mrs. David Dunlap, not only as the gracious hostess at the colourful garden party which must always remain with us as a pleasant memory, but also as the donor of the splendid David Dunlap Observatory which is in reality a gift to the entire world of science.

Therefore be it resolved that the Secretary be instructed to inscribe these sentiments in the permanent records of the Society and to send copies of this resolution to the persons concerned.

THE INTERNATIONAL ASTRONOMICAL UNION—FIFTH MEETING

By C. A. Chant

THE fifth General Assembly of the International Astronomical Union met in Paris, July 10-17, 1935. The last previous meeting was in Cambridge, Mass., in September, 1932. About 300 astronomers were present, representing 27 countries, including three new adherents, Russia, China and Jugoslavia. Germany has not yet formally joined the Union, but some German astronomers were present and were cordially welcomed. From Canada there were Director R. Meldrum Stewart of Ottawa, Dr. J. S. Plaskett and Mrs. Plaskett of Victoria, and the present writer and his wife. The weather was very warm.

The sessions were held in the Centre Marcelin Berthelot on Rue Saint-Dominique, a fine new building erected by the French Government for the teaching of chemistry. It is constructed chiefly of stone, cement, rubber, glass and iron with a considerable amount of chrome-plating. I was told by a French astronomer that it cost thirty million francs (about two million dollars) which seems an excessive price. Yet it is only half the cost of the *Normandie* or the *Queen Mary* and surely it is of much greater value to the world.

The work of the Union is carried on by means of Commissions of which there are thirty-six, although a few are not in very lively existence. But draft reports were presented by thirty-one of them. These had been prepared during the interval since the last meeting, having been drawn up after correspondence among the members of the commissions.

The official opening took place in the large lecture hall on July 10 at 10 a.m. The furnishings of this room embody the latest ideas in comfort and convenience and are in modernistic French style. The assembly was honoured by the presence of the President of the Republic, Albert Lebrun. When he arrived, with his guard, all rose, and numerous cameras and flashlights clicked into operation. French press photographers are not at all backward in going after

what they want. On the platform were M. Mario Roustan, the Minister of Education; Prof. Frank Schlesinger, president of the Union; M. Esclangon, director of the Paris Observatory; Count de la Baume Pluvinel, chairman of the French National Committee of Astronomy and of the local committee; and Sir Frank Dyson, past president of the Union. Count Pluvinel read an address, to which brief replies were made by Messrs. Esclangon and Schlesinger and a longer one by M. Roustan, during which he announced that the French Government had awarded the decoration of the Legion of Honor to Professor Schlesinger.

At the close of these formal proceedings there was exhibited a film illustrating the determination of time by the Paris Observatory. The photography was extremely well done and the accompanying low "canned" music the best I have ever heard. The Paris Observatory has long made a specialty of broadcasting accurate time signals.

The regular business of the congress began with the afternoon session when the admission of the new nations was approved, reports were received and resolutions which had been sent in by various national committees were discussed—for example (from Great Britain) that the General Assembly be asked to explore the possibility of reducing the number of symbols used for astronomical time; etc.

The commissions met usually in the mornings to discuss their reports and in some instances to hear papers from certain members. In this way those engaged in any branch of astronomy were able to exchange views and make plans for further co-operation. Then in afternoons and evenings there were receptions and excursions at which one could extend his acquaintanceship with other astronomers. These personal meetings are very interesting and valuable in carrying on one's labours.

On the evening of Wednesday, July 10, there was a reception by Director and Mme. Esclangon at the Paris Observatory. The foundation stone of this famous institution was laid on June 21, 1667, and the building was completed in 1682. Outwardly it has changed little and much distinguished astronomical work has come from it. The members enjoyed inspecting the historic building with its noted instruments, and in meeting the astronomers in the beautiful grounds. The evening was warm.

At 5 p.m. on the 11th a reception was given by the Municipality of Paris at the Hôtel de Ville. This magnificent town hall dates from 1874-82. The astronomers thronged the Salon des Arcades to listen to a fine musical programme given by the Republican Guards band assisted by Mlle. Jane Montange. Refreshments were served in an adjoining room.

Next afternoon the astronomers and their friends gathered at the Observatory and in seventeen motor-buses drove forty miles to Fontainebleau. Here they were conducted through the Chateau —now in excellent condition—and taken for a drive in the forest. There is "speeding" in France, as well as in other countries, and an impressive warning against it was seen on the way to Fontainebleau. Upon a raised platform on the roadside was a badly smashed automobile with a sign on it which said (in French), "Be prudent in your driving!"

On Saturday (weather still torrid), there was a drive to Versailles and then on to Meudon, one of the suburbs of Paris, where there was a reception and garden party at the Observatory. This is the astrophysical division of the Paris Observatory. It was founded in 1876 in the ancient royal domain of Meudon, which dates from the sixteenth century. Here is much important equipment, the outstanding instrument being a twin (visual and photographic) refracting telescope with apertures 83 cm. and 62 cm. and focal length 16 m. Refreshments were served in the great dome and afterwards a sound-film was taken in which M. Esclangon made a brief address. In it he remarked that if the astronomers had charge of international affairs there would be no wars, but co-operation between the nations.

On the next day was the Fête National, celebrating the fall of the Bastille on July 14, 1789, and the beginning of the French Revolution. There was fear of trouble between the organizations of the "Right" and the "Left", who were holding demonstrations at the Place de l'Etoile and the Place de la Bastille, respectively, and the citizens were treated to a display of 600 aeroplanes roaring over the city. Happily everything passed over good naturedly. In the evening a wonderful dinner was tendered by the Astronomical Society of France to the Union, at the first platform of the Eiffel Tower, 190 feet above the ground. About 400 persons sat

A Group of Members at the Eiffel Tower Dinner

Jackson (2), S. Afr.; Chant (2), Can.; Bruhat (2), Fr.; Bemporad (2), It.; Delvosal, Belg.; Mineur (2), Fr.; Milne (2), Eng.; Carrasco (2), Sp.; Tiercy, Switz.; Lagrula (2), Alg.; Phillips, Eng.; Norlund, Den.; Rodés, Sp.; Michkovitch, Jugo-S.; Slocum (2), U.S.A.; Robertson, U.S.A.; Schlesinger, U.S.A.; Dyson, Eng.; Deslandres (2), Fr.; Picard, Fr.; Pluvinel, Fr.; Fabry, Fr.; Bergstrand, Swed.; Niiland, Hol.; Adams, U.S.A.; Mitchell, U.S.A.; Stratton, Eng.; Baillaud, Fr.; Russell, U.S.A.; Stein, It.; Rowland, Eng.

down. It was inspiring to find one's self in the midst of the world's most distinguished astronomers and to see from a great height the night coming on, with illumination of the city and fire-works in celebration of the holiday. I was informed that the suggestion of the dinner came from Madame Flammarion, the secretary of the Astronomical Society of France.

On Monday, July 15, the President of the Republic and Mme. Lebrun gave a reception at their official residence. The day was fine and it was a privilege to move about the splendid rooms of the house and the beautiful grounds of the Palais de l'Elysée.

On Tuesday there were meetings of the Commissions and in the evening a farewell banquet at the Hotel Continental under the auspices of the French National Committee. The addresses were brief and afterwards there was dancing.

Next day the General Assembly met to receive the reports of the Commissions and to pass well-deserved resolutions of thanks.

During the meeting there was in the Centre Marcelin Berthelot an astronomical exposition at which various observatories and manufacturers exhibited instruments, models, photographs and publications illustrating their work. From this one obtained new ideas and learned directly what other persons were doing.

TOTAL ECLIPSE OF THE MOON, JULY 15-16, 1935

I. By F. K. Dalton

IT was a glorious night at Forest Glen Farm near Bolton. The day had been cloudy and rainy but the sun set bright and red. The full moon rose behind a bank of clouds in the south-east which seemingly covered Toronto, but by 9.00 p.m. E.S.T. it had passed the last small cloud and was mounting higher in a perfectly clear sky.

By 9.45 the moon was in the penumbra and shaded smudges appeared on the left side. At 10.12 it entered the umbra and the curved front of the dark shadow commenced its 57-minute travel across the disc.

The progress of the eclipse was watched through a transit telescope and it was observed that the front edge of the dark shadow was followed by a greyish band, in width about one-third of the diameter of the moon, which shaded into a brick red band of about the same width, and then into dark reddish black. Just before the shadow completely covered the moon, there were visible the narrow illuminated crescent at the right, and all of these colour bands.

The dark shadow line was always fairly narrow in the telescope and the colour bands were very striking. These colours, however, were not seen to advantage by the unaided eye.

Totality commenced at 11.09 but the bands proceeded across the moon's face until midnight, the centre of the totality period, at which time the reddish black area was centred on the moon with a narrow brick red band surrounding it just inside the circumference of the disc. The moon was very dark and its edge was not clearly visible to the eye but could be seen fairly well through the telescope. The landscape too was as dark as on a moonless night.

After midnight, the reddish black shade moved off to the right, followed by the brick red band, the grey band and then, at 12.50 a.m., when totality ended, by the direct illumination. These bands of colour continued their procession across the moon, each disappearing in turn, until, at 1.47 the moon passed out of the umbra. It soon afterward cleared itself of the dark smudges of the

penumbra on the right side, and the longest lunar eclipse of many years was over.

Not the slightest cloud nor any other handicap had marred the the enjoyment of the small party of observers who gathered to witness this celestial spectacle. In Toronto, and some other areas, however, clouds had hidden the eclipse more or less intermittently.

The colour bands and all reddish tints are due to refraction of the sun's light, with the usual chromatic dispersion, in passing through the earth's atmosphere. Clouds in the areas through which the light passes may cut off these refracted rays so that during totality the moon may not even be visible.

II. By Albert R. Hassard

This is the most interesting lunar eclipse it has been my privilege to observe. The moon was entirely within the umbra for 1 hr. 41 min., the path of the moon being central across the earth's shadow. The last two solar eclipses in Canada disappointed thousands because of cloudy skies. In the case of eclipses of the sun men have soared above the clouds, and thus in a limited way have overcome these weather difficulties. But never have I witnessed a total eclipse of the moon under circumstances as advantageous as in this one of July 15-16, 1935. As soon as darkness began to come numerous clouds were seen to cover the part of the sky where the moon was soon to rise. These clouds disheartened all but the most optimistic, and they persisted until after 9.00 p.m. E.S.T. But a little before 10 o'clock the clouds began to disperse, and in amazingly short time the sky became clear.

At about 10.15 a distinct darkening could be seen on the easterly extremity of the moon. The eclipse was commencing. The shadow was intensely black but the westerly boundary was lacking in sharpness, the margin suggesting smoke.

As the shadow crept further westward over the lunar face, the blackness of the shadow continued, and by contrast the still unobscured part of the moon seemed to grow perceptibly brighter. The "copperiness" so commonly associated with a lunar total eclipse was wholly absent at this time.

The shadow advanced until at 11.09 E.S.T. the whole moon's

face became entirely obscured, and a majestic totality commenced. The "coppery" colour made its appearance. But the copperiness was not just where it might have been expected. The centre of the moon at totality had developed into a colour I have noted as "bloody red", like the interior of a blood-red orange. I have even designated the moon as having "a fiery red centre", the outside parts being of an orange hue. Towards the circumference of the moon there was a coppery colour, and an hour later, while still the eclipse was total, the blood-red colour was gone, and the coppery colour was in its place. The moon had an "eerie" appearance. One had to reflect for a moment or two to realize that that body out there was really our celestial sister, and not Mars, or some other strange object which had suddenly obtruded itself upon our view. The Milky Way was well defined, much clearer in fact than it oftentimes appears upon a clear and moonless night.

At the end of the total phase I ceased observing. I was well repaid by what I had seen, and felt that such a spectacle as this might not again be seen by me in my lifetime.

Toronto, Ont.

POPULARIZING ASTRONOMY

By William Gifford Hale

THE very inspiring article in the February number of the Journal prompts me to give some further particulars of my own experience in this worthy cause. As was intimated in the January issue, we have kept going in Seattle for three years and a half a lively astronomical discussion club or society, and the first thing that occurs to my mind in this connection is the frequency with which meetings are held to the best advantage. I note that the Victoria Centre tried out monthly, fortnightly, and three-weekly meetings, deciding at last in favour of the monthly one. My own idea is that there is nothing like weekly meetings to keep up a living and continuous interest. The trouble of course is the difficulty of finding a supply of speakers for so frequent a series, but here is a way in which it may be got over. Have four series of subjects running, each on one particular week of the month, and let a separate speaker have charge of each series. Divide astronomy into (1) planet studies, (2) constellation studies, including locating the stars, (3) evolution of stars, and (4) instrumental study and telescope-making, slide-making for lantern work, and the historical side of astronomy. If a separate man or woman cannot be secured for each, let one person take two series. But by all means try a weekly run of meetings.

Lantern-slide making is a great help in every way, for high school boys and girls can learn to make them, perhaps painting on glass over traced designs from books. Use also the opaque projection lantern, directly projecting the picture on the screen.

Then there is the most fascinating of all, the three-dimensional model of planet orbits, showing, as no other method possibly can, the varying slope or inclination of their tracks around the sun. I have made several of these, one to include the planets out to Mars and Eros; and one to take the planets out to Pluto, in which case of course the orbits of the inner planets are very tiny, being all drawn upon a small central disc of celluloid. The orbits are made of rings

of wire, using those to be found in ready-made lamp-shades, and supporting them upon three or four wire legs holding the orbit by loops of wire, the other end of the leg being thrust through a half-inch-thick square of wood and the under ends being fastened in place by turning the wire at right angles and clipping them down by small wire nails. So by two or three models we illustrate truly the size and inclination of planet orbits, a comet path crossing them, and so on.

The inner orbits sized up thus: Mercury 6 inches in diameter, Venus 12, Earth 18, Mars 24, Eros 22, interlacing with that of Mars. More pretentious were three large terrestrial globes, painted from Lowell's maps of Venus, Mars and Mercury, used to illustrate separate lectures on these planets. Another kind, for indication of size, was got by a series of small model globes, on a scale of one inch to 8000 miles. These proved very effective when painted and put in a row on the lecture table, side by side, with an 8-foot lantern disc of light for the sun shown alongside. Saturn's ring was shown by a ring of painted tin. Yet another exhibit, to show distance from the sun, was a long roll of cloth on which were painted, or drawn in crayons, discs of the planets placed on a scale of distance of one inch to 15 million miles. On this scale Pluto came in at about twelve yards' length of the roll. So we put over, one at once, the ideas of size, distance, and shape of orbits. An old set of revolving slides is most useful for movement of any kind attracts all the boys.

That is a very rough sketch of what I tried to accomplish in popularising astronomy.

Seattle, Washington.

NOTES FROM THE DOMINION ASTROPHYSICAL OBSERVATORY, VICTORIA

In continuation of the observing statistics from the February issue of the JOURNAL, we have the following from the records of the observatory:

	1935		16-year average	
Month	Nights	Hours	Nights	Hours
January	5	6	10	64
February	12	104	14	92
March	16	76	16	124
April	20	120	17	100
May	23	131	21	105
June	23	122	19	91
July	23	119	24	129
August	27	175	24	147
September	21	198	20	146

The month of January constituted an all-time low record for observing. Possibly full advantage was not taken of every clear moment since the secondary mirror was away all month at Pasadena being aluminized. Even so the month was the poorest on record. Apart from that the observing weather has been somewhat better than the average for the past sixteen years.

The visitors to the observatory have been on the increase as compared with the past few years, though the numbers have not attained to those of the peak year, 1929. The numbers for the nine months of the present year are respectively 160, 240, 347, 899, 1218, 1584, 6922, 7567 and 1160.

Among these from time to time are astronomers from other observatories whom we are always glad to welcome. Among such the past few months may be mentioned Dr. and Mrs. W. C. Rufus of Ann Arbor who were simply passing through the city on an extended trip. From the Ann Arbor Observatory we had also Dr. Hazel M. Losh, who gave us a very interesting seminar talk on her work at the Detroit Observatory and then later in the season the Director of the same observatory, Dr. H. D. Curtis, who with his son, Baldwin, a student at the University of

Michigan, paid a flying visit. Mr. W. W. Mills, associated with the McMath-Hulburt Observatory, with Mrs. Mills, were also visitors. From the Harvard Observatory we had Dr. F. T. Whipple, formerly connected with the Mount Wilson Observatory, and from he Royal College of Science Professor A. O. Rankin. We were sorry to have missed seeing Professor A. J. Dempster of the University of Chicago on the occasion of his hurried visit.

Two new appointments to the staff have been made in the persons of Dr. R. M. Petrie and Dr. Andrew McKellar. Both were formerly seasonal assistants during their student vacations, the former taking his post graduate work at the University of Michigan and the latter at the University of California and the Massachussetts Institute of Technology.

Dr. C. S. Beals and your scribe attended the meeting of the Royal Society at Hamilton in May, where they presented papers of their own and of other members of the staff. Your scribe stayed over for and had a small part in the ceremonies in connection with the opening of the David Dunlap Observatory. Dr. J. A. Pearce was the observatory's representative at the meeting of the American Astronomical Society at Toronto in September and presented several papers from the observatory.

We are pleased to report a few improvements in the grounds and buildings. An attempt at reforesting the burned over area has been made by setting out this spring nearly 1,500 small spruce and cedar and fir trees. If the experiment proves successful further efforts in this direction may be made.

The buildings have been much improved through painting. Early in the spring the outside of the dome was painted with aluminum paint and it is now quite an outstanding landmark. The inside of the building has just been given a coat of paint also, the first since erection in 1917, while the two houses and office building have likewise been brightened up. The Public Works Department have also completed the large cement reservoir with pipe connections to various parts of the grounds so that the fire hazard is greatly reduced.

W. E. H.

REVIEW OF PUBLICATIONS

Introduction to Astronomy by ROBERT H. BAKER. 312 pages, 6 x 9 in. N.Y., Van Nostrand, 1935. Price $3.00.

One of the best text-books published in recent years was Baker's *Astronomy* which appeared in 1930. It was elementary but adapted specially for students with mathematical tastes or aptitudes. The present work is pitched somewhat lower and is intended for those who cannot devote so much time to the subject. It has the good features which characterize the other book.

The work begins with a chapter on the earth and the sky and treats the globe of the earth, the seeming globe of the sky and the earth's atmosphere. The first illustration in the book is the photograph of the Andes mountains, taken in Argentina at a distance of 300 miles, which clearly shows the curvature of the earth's surface. Then the rotation of the earth is discussed, with the methods of counting time, sidereal and solar. The many complications which arise through apparent, mean, standard, daylight-saving time and the change of day are explained clearly although necessarily briefly. Chapter III deals with the revolution of the earth around the sun. Then come two chapters devoted to the constellations and the stars in their seasons. There are numerous excellent diagrams, maps and photographs. Indeed these chapters are distinctive of the aim of the book—rather for culture than definitely for science.

After this follow chapters on the moon, the paths of the planets, the planets and their satellites, other features of the solar system, sunlight and the sun, and then there is an excellent treatment of the stars around us, stars and nebulae, within the milky way and beyond the milky way.

There are many original diagrams and new photographs. Reference is made to Elvey's study of the gegenshein at the Yerkes Observatory in 1932, using a photo-electric cell, and the study of meteor craters in Australia, Arabia and other places. There are also photographs of the spectra of stars showing the widening of the lines, presumably due to rotation, and other recent developments. Another valuable feature is the list of questions at the end of each chapter. The book deserves a wide usage. C. A. CHANT.

METEOR NEWS

Observations relating to meteors and meteorites are cordially invited.

SUMMER FIREBALLS.

Observation of the Perseids was greatly hampered this year by bright moonlight and, added to this, poor weather conditions at many of the observing stations. In spite of this fact a large number of visual observations were received and these will be discussed in detail next month. Those who observed near the beginning of August fared the best in this summer's work.

As usual, a number of exceptionally bright meteors, or fireballs, were observed during the summer months. Four of these reported to the writer are deserving of special mention.

July 31, 8.30 p.m., E.S.T. This meteor was observed in the north from several points in and near Toronto. It was estimated to be a bit brighter than magnitude —4 and appeared before the end of evening twilight. It is of particular interest because of the enduring train which remained for about ten minutes after the meteor disappeared. The train was twisted into an "S" form by the currents in the upper atmosphere. This is a very characteristic behaviour for enduring trains.

Aug. 2, 12.12 a.m., E.S.T. This object was the brightest meteor reported this summer but did not receive general attention, owing probably to the late hour of its appearance. It was seen in the north from both the Ottawa Observatory and the Lake of Bays. The estimated magnitude was —9, in other words about one hundred times the brightness of Venus. It was green in colour and burst near the horizon.

Aug. 6, 12.15 a.m., E.S.T. This fireball also appeared in the north as seen from southern Ontario and was of magnitude —4. The extreme slowness of its fall was particularly noted as was its bluish-white colour.

Aug. 30, 9.00 *and* 10.10 *p.m., E.S.T.* There were apparently two bright meteors seen on this night. Both appeared almost due south of Toronto and near the horizon. Estimated magnitudes were

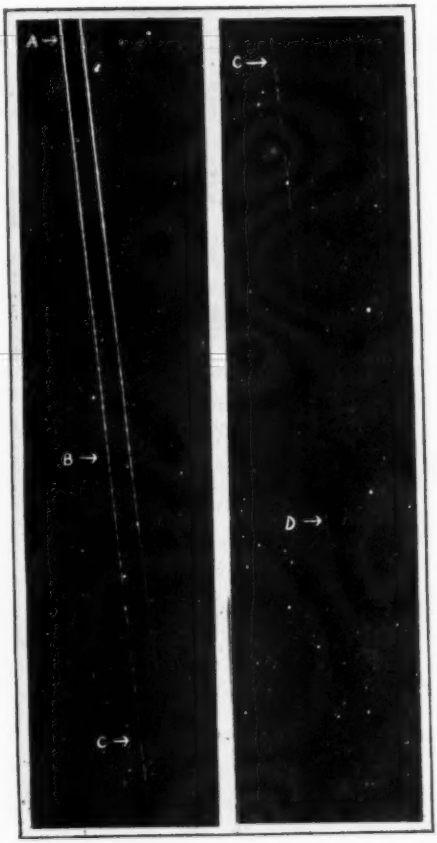

Fig. 1—Multiple meteor trail photograph taken Nov. 7, 1934, by Mr. K. Kubokawa.

—5 and —6 respectively. Colours, purplish for the first and orange for the second.

The writer is very anxious to receive reports from anyone who observed any of the fireballs described above. Please address all correspondence to the Dunlap Observatory, Richmond Hill, Ont.

A Remarkable Multiple Meteor Trail

The writer has recently received from Mr. Y. Iba of Kobe, Japan, a contact positive of one of the most remarkable meteor photographs which it has been his privilege to examine. This photograph is reproduced in figure 1. It was taken by Mr. K. Kubokawa, Junior Astronomer at the Tokio Observatory, during a programme of asteroid photography. The meteor appeared at 22 hours 08 minutes standard time on November 7, 1934. It was estimated to be three times as bright as Venus, velocity slow, duration 4 or 5 seconds, and colour bluish-white. The instrument used was a Brashear 20 cm. astrographic with a focal length of 127 cm. The photographic trail extends for nearly 8° across the plate while the visual trail was reported as being about three times this length.

The meteor entered the field of the camera at *A* (see figure), appearing as a strong double trail with a very faint suspicion of a third trail between the other two. The right hand trail divides at *B*, the faint component to the left being indicated by a series of faint bursts between *B* and *C*. The left hand trail divides *D* into two trails of nearly equal intensity. All the trails have numerous bursts along their length and these exhibit various types of rather complicated periodicity. The careful study of these will be of great interest. The main trails themselves separate slightly as we go from *A* to *D* and the writer believes it probable that the meteor entered the upper atmosphere as a single body and that the initial breaking into pieces occurred before the meteor entered the field of the camera or perhaps even before the meteor became visible.

Photographic Observations of the Perseids, 1935.

The photographic programmes did not meet with very much success this year. The bright moon plus considerable haze and dew did not improve conditions. Mr. A. D. Misener, assisted by Mr. R.

B. Laing, made exposures with two spectographs at the Dunlap Observatory. Mr. E. M. Cook and the writer made exposures with five spectographs at the Oak Ridge station of the Harvard Observatory. Ilford Meteor Panchromatic and Cramer Iso-Presto plates were used. No spectra were photographed, however, at the above stations. Mr. A. H. Armstrong and Mr. D. A. McRae, using a direct camera at Kincardine, Ont., secured a fine photograph of a bright Perseid with a good terminal burst. Mr. Philip Perry made exposures with a direct camera at Huttonville, Ont., but did not secure a meteor photograph. The writer has also heard from the observers at the Ottawa Observatory and the Texas Observers of Ft. Worth and they report no meteors photographed during the Perseid observations. Mr. Alfred Boyles of Ensley, Alabama, has already secured a number of direct meteor photographs. During the observations of the Perseides in 1935 he photographed five meeteors with a direct camera. Three of these were secured within one hour. Mr. Boyles is to be congratulated, not only on the number of his meteor photographs but also on the excellent quality of his plates, many of which are guided and are of professional grade. It is encouraging to see the number who are seriously taking up amateur meteor photography.

The details of the photographic programmes are listed below:—

Place	Date	Total Exposure Time	Meteors Photographed
Spectrophotography			
Dunlap Observatory, Ont.	Aug. 10-13	10.2 hrs.	..
Oak Ridge, Mass.	Aug. 10-13	20.3 hrs.	..
Direct Photography			
Kincardine, Ont.	Aug. 11-12	1.5 hrs.	1
Huttonville, Ont.	Aug. 10-13	3.2 hrs.	..
Ensley, Ala.	Aug. 9-12	5.0 hrs.	5

Errors in Altitude Estimates

Visual estimates of altitude by untrained observers often enter into the reduction of meteor data. Results from a series of altitude estimates by students at the University of Toronto were reported in these notes for February of this year. Miss F. S. Patterson of the Department of Astronomy at the University has recently con-

ducted a similar test. A total of over 350 unbiased altitude estimates of 16 stars were made by 21 students. The true altitudes of the stars varied from 10° to 75° and it was found that, on the average, the estimated altitudes were systematically too high by 8°. The probable error of an individual altitude estimate was 6°. These results are in very good agreement with those obtained before.

THE LEONIDS, 1935

So much has been expected of the Leonids in recent years and so little of a spectacullar nature has happened that they are generally remembered as a consistent disappointment and certain pertinent facts of their history are commonly forgotton. One of these is that the Leonids in the past have not appeared in great numbers regularly every 33 or 34 years. In some cases over 100 years elapsed without the record of a great shower. Again, the maximum number of meteors often appears one, two, or even three years away from the computed maximum year. From the very nature of a meteor shower we cannot count on its appearance as we would on the return of a well-known comet or asteroid. Normally, meteors are seen only when they come in contact with the earth's atmosphere and perturbations of a few hundred thousand miles may be enough to render them invisible. There is no doubt that the Leonids of 1833 provided one of the most spectacular sights the heavens have afforded but they were almost totally absent in 1899 and 1900.

A careful study of the behaviour of the Leonids during the last thousand years led investigators to consider either 1932 or 1933 as the most probable years for the maximum display at this return. Actually more were seen in 1931 than in any other recent year. It is impossible to predict what will happen in 1935. The chances look rather against a remarkable shower. However, one thing is certain, careful records of this year's shower will be of great scientific value no matter what number of meteors appears. Thanks to the general interest in the Leonids more information than ever before has been collected about them during the last four or five years, but it is essential that we have just as complete a record of observations during the next few years. The Leonids of 1935 should be observed,

then, not so much with the idea of witnessing a marvellous display but with the purpose of adding definitely to our knowledge of this interesting group of objects. The true scientific attitude, whether of professional or amateur, recognizes that often it is just as important to record the absence of certain phenomena as to record their presence.

It is hoped that all those interested in meteors will make an effort to observe on at least one night. The Leonids will probably be most numerous on the three nights of Nov. 15-16, 16-17, and 17-18, the centre night of the three being the computed maximum. The moon will be at the last quarter and uncomfortably near the radiant but this will hinder meteor photography more than it will the visual work. Maps and instructions for these observations may be secured from the writer.

Unusual Meteors

What might be termed the typical meteor generally appears as a small point of light which, moving swiftly across the sky in a straight path, first steadily increases then decreases in luminosity. This is often varied by the meteor exhibiting a marked colour or by a burst of increased luminosity occurring at one or more points on the path. A faint luminescent train also may remain for some time after the meteor has disappeared. In addition to the above characteristics, however, there are peculiarities which appear more rarely but which should be carefully recorded when present. Some of these unusual cases are described below to illustrate the necessity of the meteor observer keeping an open mind. He should avoid any preconceived opinion as to the appearance of the meteor and attempt to record only just what he sees.

Colour Changes. Sometimes a bright meteor definitely changes colour as it proceeds along its path. Since the spectrum of a meteor is a bright line spectrum this colour change is no doubt often due to the predominance in its light of first one set of lines and then another. For this reason the recording of colour changes is of great importance. Various parts of the head of a great fireball may exhibit different colours simultaneously. A very remarkable meteor was reported by E. H. Collinson in the *Observatory* for 1922. It appeared

on the evening of Dec. 4, 1921, being, when first seen, of the third magnitude. It then brightened to several times the luminosity of Venus and broke in fragments, one of these being blue, another red, while the main fragment remained a clear yellow and was pear-shaped in form.

Multiple Meteors. While in general a meteor appears as a single object occasionally two or more meteors are seen moving together in parallel paths. Here the interesting problem is: Did the various members of the group exist as separate objects in space or did a single object break up on first contact with the earth's atmosphere? In most cases the second view seems the correct one. An example of this type is the fireball of Feb. 12, 1934, reported by Mr. Nininger in *Popular Astronomy*. In this case three objects of the brightness of Venus were observed moving in a fixed formation. On April 24, 1935, Mr. B. Topham of Toronto observed two dull red meteors moving side by side over a large arc of the sky. The classical example of a group of meteors moving along the same path is the great meteoric display of Feb. 9, 1913, reported by Professor Chant in the JOURNAL for that year. In this case between 200 and 400 objects travelled in several groups through the earth's atmosphere from Saskatchewan to a point south of Bermuda.

Curved Paths. A small percentage of meteors show paths which noticeably deviate from a straight line. An extreme example of this kind was observed on April 30, 1934, by a group of students from the University of Toronto. Here the meteor first appeared falling vertically, then swung to the right, and finally almost doubled back on itself and proceeded to the left in an approximately horizontal path. No doubt in this case the degree of curvature was greatly exaggerated by foreshortening.

Under this same heading may be noted meteors which have sinoidal or wave-like paths. This probably arises from the rotation of an irregularly shaped mass. A fine drawing of such a meteor by W. H. Steavenson is reproduced in "The Splendor of the Heavens". A sinoidal Leonid path was photographed at Harvard in 1932 (H. A. vol. 82, pt. 7, 1935). A number of meteors which exhibit a periodic flicker have been photographed and this type would no doubt show a waved path were the meteor recorded on a sufficiently large scale.

Nebulous Meteors. To the eye a meteor usually appears as a very fine point of light tracing out a fine line across the sky. This appearance is confirmed by photographs which show that, when the focus is good and halation absent, a meteor path has effectively no width even in the case of very bright fireballs. Exceptions have been noted, however, in the form of so-called nebulous meteors. One was reported by E. M. Antoniadi in *Astronomische Nachrichten* for 1914 and several cases are described by F. Baldet in the *Bulletin of the Astronomical Society of France* for 1909. Such meteors seem to have no sharp nucleus but appear hazy, and are often likened to the coma of a telescopic comet. During the photographic observations of the 1933 Leonids carried out at the Harvard Observatory a meteor was photographed both directly and with a spectograph. On both plates the image of the meteor is diffuse and hazy though the sky was clear and the star trails impressed at the same time are quite sharp. Observations of such meteors, both visual and photographic, are of the greatest importance in a consideration of the physical theory of a meteor's luminosity. P. M. M.

THE EARTHQUAKE

Some subterranean monster, roused from sleep,
Goes plunging through the caverns of the deep,
Stamping in fury on the earth's thin floor,
Making the vault reverberate with his roar.

Crushed by the anger of the elements,
The gaping earth is torn in fearful rents.
With horror-stricken eyes we see the hills
Torn from their ancient rocky citadels.

The tides, inviolate of time or space,
Loosed from their bounds, in floods terrific race.
Death rides upon the waves with ruthless power,
And swift destruction marks the tragic hour.

Dark clouds hang lowering o'er the dreadful scene,
While vivid lightnings rend the veil between
The trembling earth and the unstable skies,
Shattered by thunder's loud antiphonies.

The forests moan, the distant mountains quake,
The parched streams in panic fear forsake
Their olden ways, the while the shrinking earth
Renews again the anguish of her birth.

Frail man, the sport of nature's savage laws,
Ignorant alike of purpose and of cause,
Lies grovelling in the dust, a thing of scorn,
An atom in a waste of worlds forlorn.

ALEX. H. SUTHERLAND.

Victoria, B.C.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

Centenary of Newcomb's Birth

Simon Newcomb was born on August 21, 1835, at Wallace, N.S., and on August 21 last there was unveiled at that place a cairn erected to his memory. Among those present was the United States Minister to Canada. A short time later I happened to be reading "Sixty Years as a Publisher", by Henry Holt (pub. 1923) and came across the following reference to Newcomb, who was one of Holt's numerous friends. It gives a pleasing light on the great astronomer's personality:

He was a leading astronomer and mathematician, an eminent economist, and wrote a novel. He was a thick-set man of middle height, with grayish eyes and, in later years, an abundance of grayish, waving hair and beard. His face had a very peculiar expression which makes me recall it with peculiar vividness: it was made up of calmness, keenness and kindness. In virtue of his being director of the Naval Observatory at Washington he was an admiral, and yet when he visited us at Lake Dunmore he told us that he had never rowed a boat. But when we put him into one, he rowed it as straight as either of us could, and we had "always" rowed. He was devoted to the ladies of my household—a proof of the best of taste, and yet he was the sort of society man who shook hands with the high contracting parties at a wedding reception without saying a word, and when a friend asked: "Why didn't you say anything", answered: "I hadn't any facts to impart".

At the End of a Rainbow

The publication in the July-August Journal of my short article on "Thoreau and his Rainbow" has brought some interesting correspondence. Mr. David W. Rosebrugh, of Poughkeepsie, N.Y., sends a quotation from *Nonsuch, Land of Water*, by William Beebe, director of the Department of Tropical Research of the N.Y. Zoological Society (N.Y., 1932), pages 12 and 14, which is given below. I have no comments to offer.

I noticed that there was a mist of sorts between me and the stratified sand near by. I looked up and as far as emotional effect went, a full charge of

H.E. might have gone off at my elbow. I experienced a visual shell-shock, for high overhead there was etched the strongest, most materialistic rainbow I have ever seen, one end of which began in mid-air, and the other curved down, down, down, holding true from red to violet, to the rocks beside me. Once before, on a Guiana jungle river, I have been actually at the end of a rainbow, when, at my very side, one coloured the bulwarks of our Akawai canoe . . . .

And now for two exciting sequences: I published this chapter in the *Atlantic Monthly*, and at once had a telephone from a Great Physicist, who is also to me a Best Friend.

"Ho! Ho!" said he, "at last I have caught you in an honest error. I believe you thought you saw, but you could not possibly have seen, a rainbow which began at your very side, and yet which arched away into a curve overhead. Optics say impossible. I will tell you about it when I see you."

A week later the G.P. who was also the B.F. lunched with me, and when pencils gave out, we used forks on the tablecloth, much to the waiter's anguish and my confusion, for by this time the G.P. had worked himself into a fever heat of joy, because he had discovered that I probably did see what I wrote, explicable only by a little known kink of physics, a kink whose mathematical formulas left me hopelessly stranded. It will be published in some suitable place, and I shall then point with pride to the proof of my experience, but in this world I shall never exactly understand it.

Death of Rev. J. T. W. Claridge

The present writer learned with regret of the death in September last of Rev. J. T. W. Claridge, M.A., of Melton Mowbray, Leicestershire, England. Mr. Claridge was elected to the R.A.S. in 1894 and to our Canadian society in 1907. For some years he was a contributor on astronomical topics to the *Birmingham Mail* and the *Melton Mowbray Times*. Under date August 14, 1935, Mr. Claridge renewed his annual subscription and added the following kindly remarks: "The monthly Journal is always highly welcomed, with its varied and useful astronomical articles, and I greatly value the knowledge it helps me in my study of our ancient and wonderful science."

Speedy Satellites and Martian Eclipses

Dr. Roy K. Marshall, of Wilson College, Chambersburg, Pa., sends the following considerations which were suggested by the report of a lecture by Dr. Helen Hogg to the Toronto Centre on

April 13 last and which was printed in the JOURNAL for July-August (see p. 252).

In the printed report of the Toronto meeting of April 30, 1935, Dr. Helen S. Hogg is quoted as stating that "Phobos is the only satellite in the solar system which revolves around the planet in less than the rotational period of the planet itself". In order to consider this statement, in the most rigid sense, a true one, one must exclude the countless tiny bodies which compose the rings of Saturn, for all the particles of the rings which lie within about 31,000 miles of the surface of Saturn revolve about the primary in less than 10 hours 14 minutes, the rotation period of Satturn. The inner edge of the crêpe ring is only about 6,000 miles from the surface of the planet. All the particles of the crêpe ring and those of the inner 14,000 miles of the 18,000-mile-wide Ring B revolve in less than the period required for Saturn to turn on its axis.

In the same paragraph it is stated that "Mars would be a happy hunting ground for the astronomer who is an inveterate eclipse follower, for there occur several eclipses each day". In order to hide the sun completely, the inner satellite, Phobos, would need to be at least 22.6 miles in diameter, while Deimos would have to be almost 76.5 miles in diameter. It is generally agreed that the diameters of these satellites do not exceed 20 miles. The passage of Deimos before the sun must surely, then, be spoken of as a transit, rather than an eclipse, and it is likely that all eclipses produced by Phobos must be, at best, central or annular. However, in view of the low density of the Martian atmosphere, it is at least possible that the solar corona would be visible even if the disc of the sun were not entirely covered.

C. A. C.

MEETINGS OF THE SOCIETY

MEETINGS OF THE SOCIETY

AT HAMILTON

June 11, 1935.—The annual field night of the Hamilton Centre, was held on the above date. A postponement from June 10th was necessary owing to adverse weather conditions.

The spacious grounds of Mr. W. T. Goddard's home, Paradise Rd., furnished an ideal site for viewing the heavens. Nine telescopes were trained on various stars and planets, each instrument under the supervision of a member of the society.

Approximately 450 visitors took advantage of the opportunity of viewing the night sky and those in charge were kept busy until a late hour.

Possibly the first object to be observed was Venus, and an excellent view of the planet was obtained before it dropped below the western horizon. The other planets, Mars and Jupiter, very soon after appeared and were examined. The four chief moons of Jupiter and the bands crossing the planet's disk were clearly seen, and caused much comment. The moon was very brilliant, being just past first-quarter, and greatly interested those viewing it at close range for the first time.

With the more powerful telescopes star clusters, binary systems and nebulae, invisible to the naked eye, were revealed in their lonely places hundreds of light years in space.

During the evening refreshments were served by Misses Beryl and Phyllis Goddard. The field night proved an outstanding success and the thanks of the society are extended to all who aided in the activities of the evening and in particular to Mr. and Mrs. Goddard for their kindness and hospitality.

October 8, 1935.—On this date the Hamilton Centre held the first gathering of the fall season in the new place of meeting, the Art Gallery. The president, Dr. W. Findlay was in the chair.

The chairman welcomed all members and friends and spoke briefly on the future season.

Several members then gave brief talks on their summer observations.

Mr. John A. Marsh addressed the meeting on the subject, "Her Lunar Majesty—the Moon". Mr. Marsh drew a vivid word picture of the wonders and the silent grandeur of the earth's closest companion. Transporting his hearers to a position outside the planetary system, the speaker discussed the sight of earth and moon acting similarly to a binary system in the universe, while at the same time following their unceasing revolution around the sun. Several

reasons were advanced which have led astronomers to the unanimous conclusion that the satellite is entirely devoid of any atmosphere, allowing an unobstructed view of every surface feature.

A closer inspection then caused one to believe he had become a citizen of the lunar globe. Observing its mighty mountain chains, gigantic craters, ridges, cracks, hills and plains a deep sense of awe is felt at the startling wonders revealed on every hand.

Mr. Marsh concluded by stating that the moon is incapable of supporting any form of life as known to man. It is truly a dead world, airless, waterless, colourless—a planet of no future, only a past.

NORMAN GREEN, *Secretary.*

AT VANCOUVER

Summer Meetings

July 6.—At the home of Mr. H. P. Newton where his 5½-inch Howard Grubb refractor was set up. Fair evening of average visibility but seeing poor. About a dozen members observed Jupiter and Mars under Mr. Newton's direction, and listened to interesting items of information concerning these planets from Mr. Newton's long experience observing them.

July 22.—At the home of Mr. J. Teasdale, using a 6-inch Newtonian reflector. Visibility good and seeing fair. About 20 members were present and various objects were studied, including Saturn in the later hours.

August 3.—At the home of Mr. Carl Jorgenson. Very small attendance owing to uncertain promise of the evening. However the sky cleared and the party had the opportunity of using Mr. Jorgenson's refractor, made by himself, which appears to be of fine quality. Its performance on stars and planets and its workmanship are a credit to its maker.

The party also used his 8-inch Newtonian reflector, housed in a comfortable dome observatory of wood. Later, indoors, Mr. Jorgenson gave a demonstration of spectroscopy with a spectroscope of his own construction, and much interesting discussion was enjoyed by the party.

The society owes a great debt to Mr. J. Teasdale and to those who extended their hospitality.

C. A. MACDONALD, *Secretary.*

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